

Prevalence of diphtheria in a tertiary care hospital of Western part of India – A clinicoepidemiological study

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ABSTRACT

Background: Diphtheria, a very common vaccine-preventable disease, is still persistent in India without much decline in the past decade. **Objective:** The objective of this study was to study the clinicoepidemiological profile of diphtheria in children up to 12 years of age, their outcome in tertiary care hospital of Western Gujarat. **Materials and Methods:** This prospective observational study was conducted among 164 children admitted in the tertiary hospital of Western Gujarat, who were diagnosed with during the period of July 2016–August 2018. **Results:** It was observed that the highest prevalence of diphtheria was seen in the age group of 5–9 years. There was slight male preponderance with 1.5:1. The majority of patients were referred from rural areas. Immunization status was the most determining feature as 68 patients out of the study population were unimmunized at the time of admission. **Conclusion:** The rise in the prevalence in more advanced age group of 8–12 years might be due to waning immunity and emphasizes on the need for increasing primary immunization coverage along with both booster doses in areas having less adequate health-care facilities or poor access.

Key words: *Booster doses, Diphtheria, Immunization status, Mortality, Myocarditis*

Diphtheria is an acute infectious disease of the upper respiratory system caused by toxigenic strains of *Corynebacterium diphtheriae*. The organisms are locally invasive and secrete soluble exotoxins, which can lead to serious consequences mainly involving the heart muscle, nervous system, and kidneys. For case finding purpose, the WHO has suggested the definition of a suspected case of diphtheria as an illness of the upper respiratory tract characterized by the following: Pharyngitis, nasopharyngitis, tonsillitis or laryngitis and adherent pseudomembrane of the pharynx, tonsils, larynx, and/or nose. Dislodging the pseudomembrane is likely to cause profuse bleeding [1].

Diphtheria, a very common vaccine-preventable disease, is still persistent in India without much decline in the past decade [2,3]. After the introduction of Universal Immunization Program in 1985, there was a sudden decline in incidence of diphtheria by 1999 worldwide including India (about 79%). However, after the year 2000, a number of outbreaks have been reported from different districts of India [4-6]. India still contributes 18–84% of overall world load of diphtheria [7]. In the year 2018, there were 8788 diphtheria cases across the whole nation. Considering the recent resurgence of diphtheria, it was decided to study the clinical profile and epidemiology of diphtheria cases. Control of disease can be obtained by strong awareness among people for routine immunization and mass immunization campaigns. The present study aimed to study the clinicoepidemiological profile

of diphtheria and its outcome in a tertiary care center of the city in Western region.

MATERIALS AND METHODS

This prospective observational study conducted from July 2016 to August 2018 on all patients of diphtheria up to 12 years of age admitted in pediatric ward. The neonates were excluded from the study. Every consecutive patient, satisfying the WHO clinical classification of diphtheria, was included in our study. The primary outcome was to correlate the cases with the immunization status and secondary outcome was to assess the morbidity and mortality pattern. The study was approved by the Institutional Ethical Committee. Written informed consent was taken from the parents.

The data were recorded in the form of demographic details, clinical features, and laboratory confirmation by throat swab smear for *C. diphtheriae* and culture and presence of complications, if any. The immunization status was documented as per the information given by the parents and confirmed with immunization card. Those who had received three primary doses at 4–6 weeks interval starting at 6 weeks of age followed by booster doses at 18–24 months and 5 years were recorded as “Immunized.” Those who had not received any dose were considered “Unimmunized.” Patients who had missed one or more of the three primary doses or booster doses were included as “Partially immunized.”

Complete blood count and renal function tests with serum electrolytes were done in all patients, while chest X-ray and electrocardiogram, creatine phosphokinase (CPK)-myocardial band, CPK total, and electromyography-nerve conduction study (nerve conduction velocity) were done as and when indicated. Throat swabs for direct microscopy for *C. diphtheriae* and its culture were collected soon after admission by a single person trained for the collection method. Staining of the smears was done by Gram stain and Albert stain method, and culture was plated on Nutrient Agar, MacConkey Agar, Tellurite-Chocolate Agar, and Löffler's serum (last two being selective media) and was identified based on differences in biochemical reactions, as per standard methods. All patients received a defined dose of antidiphtheric serum and appropriate antibiotics. Those patients who developed complications were given treatment as per the need, most requiring carnitine therapy, tracheostomy, and ventilator support.

RESULTS

Of total 13,447 indoor admissions, 130 patients satisfied our inclusion criteria and were studied in detail, which make the prevalence of diphtheria as 9.7/1000 hospitalized patients. Most of the patients were from 5 to 9 years of age group, which showed recent shift in age of patients to older age groups. Nearly two-third, i.e., 88 (67.69%) patients were from rural area and 50% belonged to lower socioeconomic class according to modified Kuppuswamy scale. Most of the patients belonged to Hindu community (Table 1). Most of the patients were clustered from the months of August–December with peak in September (Fig. 1).

Table 1: Demography and clinical profile of diphtheria patients (n=130)

Variable	Number of patients	Percentage
Age group (years)		
<1	2	1.5
1–5	31	23.84
5–9	72	55.30
>9–12	25	19.20
Sex		
Male	78	60
Female	52	40
Area		
Rural	88	67.69
Urban	42	32.30
Clinical features		
Fever	127	97.69
Cough	117	90
Throat pain	110	84.61
Difficulty of swallowing	71	54.61
Dyspnea	89	68.46
Change of voice	49	37.69
Bull neck	39	30
Stridor	11	8.46
Bleeding manifestations	7	5.30

Throat swab was positive for Albert stain in 10.7% (14) and Gram stain in 7.6% (10) of cases while culture was positive in 4.6% (6) of patients. Of them, 3, 1, and 3 cases expired, respectively.

A total of 76 (58.46%) were discharged successfully and 22 (16.92%) patients expired. We observed maximum mortality in totally unimmunized patients ($p < 0.05$), while partially immunized patients mostly had myocarditis (Tables 2 and 3). The patients in which interventions were started within 72 h of onset symptoms had minimum morbidity and all were successfully discharged.

DISCUSSION

In our study, 55.3% of patients were from the age group of 5 to 10 years. This might be due to lack of booster immunization and weaning of immunity of primary doses in later age. In the present study, the occurrence was more in males than in females. This was in accordance to the previous study by Patel *et al.* [8]; however, Laha and Misra [9] found no significant sex predilection. In our study, 91.5% of cases were either unimmunized or not immunized completely. Only 11 (8.50%) patients were fully immunized with mild form of disease and were discharged successfully. Complete immunization including all boosters has a strong protective value for disease.

To prevent outbreaks 90% of children, <1 year should be immunized with DPT vaccine completely. Various studies have implicated poor vaccination services and low awareness among parents as the major reasons for poor immunization coverage [10–12]. In certain areas, health centers might not be easily accessible. However, more significantly, the child might

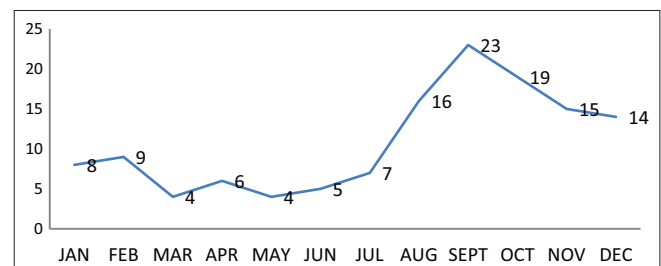


Figure 1: Seasonal distribution of diphtheria

Table 2: Complications in diphtheria patients

Complications	Patients	Mortality	Percentage
Myocarditis	71	21	29.6
Airway obstruction	24	7	29.2
Polyneuropathy	21	2	9.5
Renal failure	10	1	10
Thrombocytopenia/DIC	9	1	11.1

Table 3: Correlation between immunization status and outcome

Immunization status	Total patients (%)	Mortality (%)
Fully immunized	11 (8.5)	0
Partially immunized	45 (34.6)	5 (11.11)
Unimmunized	74 (56.9)	24 (32.43)

not be vaccinated despite a contact with the health facility. In the present study, patients who came late and who were totally unimmunized had complications such as myocarditis and death (case fatality rate 16.92%).

In the present study, diphtheria outbreak occurred in the month of August–December with peak in September. This was in accordance with the previous studies by Patel *et al.*, Laha and Misra, and Ray *et al.* [8,9,13]. In our study, the most common clinical feature associated with diphtheria was fever which was in accordance with the recent study by Dash *et al.* [14]. In our study, diphtheria was diagnosed mainly on the basis of clinical findings and it was confirmed microbiologically in 10.07% of the cases. Ray *et al.* observed low microbiological confirmation rate and suggested that the clinical diagnosis of diphtheria should be given due consideration [13]. In the present study, throat swab for Albert stain was positive in only 10.7% of cases, whereas it was positive in 21% of cases as reported by Dash *et al.* [14]. In our study, the most common complication was myocarditis followed by airway obstruction, whereas airway obstruction was the most common complication reported by Dash *et al.* [14].

The early and prompt treatment prevents mortality. *Corynebacterium* is susceptible to antimicrobials such as penicillin, erythromycin, clindamycin, and metronidazole. Therapy is to be given for 14 days. It is important to maintain isolation, treat carriers, and prevent spreads. Prognosis is guarded until complete recovery of myocardial complication, laryngeal obstruction, palatal, pharyngeal, and peripheral neuritis might occur at various stages of disease. Myocarditis, aspiration, regurgitation, and obstruction of respiratory tract might prove fatal. The worldwide mortality is 5–10% [15].

There were few limitations of our study. The majority of the study subjects represented Western part of Gujarat and we were not able to establish linear relationship between complications and disease.

CONCLUSION

Diphtheria is still prevalent in our region with the occurrence of disease in older age groups. Complete immunization is the gold standard for prevention and better outcome of the disease. A good surveillance system is essential to detect the possible outbreak of diphtheria as early as possible. Early identification and timely

intervention is lifesaving for this potentially life-threatening disease.

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